

ECTOPARASITIC TRICHODINIDS (PROTOZOA, CILIOPHORA, PERITRICHIDA) FROM SOME FRESHWATER FISHES IN THE CHONGQING AREA, CHINA, WITH DESCRIPTION OF A NEW SPECIES OF THE GENUS TRICHODINA EHRENBURG, 1838

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Abstract Three species of freshwater fishes were examined for ectoparasitic trichodinids in Chongqing, China. Trichodinids belonging to three genera, *Trichodina* Ehrenberg, 1830, *Trichodinella* (Raabe, 1950) Sramek Husek, 1953 and *Tripartiella* Lom, 1959, were investigated. One species, *Trichodina obtusiformis* sp. nov. was isolated from the gills of cultured *Aristichthys nobilis*. The other four known species, *Trichodina acuta* Lom, 1961, *Trichodina nobilis* Chen, 1963, *Trichodinella epizootica* (Raabe, 1950) Sramek Husek, 1953 and *Tripartiella macrosoma* Basson & Van As, 1987, were reinvestigated. This is the first record from China for both *Trichodina acuta* and *Tripartiella macrosoma*.

Key words Ciliophora, Peritrichida, Trichodinidae, new species, freshwater fishes.

1 Introduction

Up to now, several investigations of peritrichous ciliates, especially for the trichodinid ectoparasites from freshwater and marine biotopes are reported (Chen, 1963; Li, 1990; Xu *et al.*, 1999a, 1999b, 2002; Ji *et al.*, 2005). This paper is a continuation of previous work (Tang *et al.*, 2005a, 2005b; Zhao & Tang, in press), presenting the results of a systematic research of trichodinid ectoparasites from various freshwater fishes like silver carp, variegated and grass carp in Chongqing.

During our surveys of trichodinids on the freshwater fishes *Hypophthalmichthys molitrix*, *Aristichthys nobilis* and *Ctenopharyngodon idella* in the Chongqing area, some trichodinid species were isolated and investigated. One of species is a new species to science, *Trichodina obtusiformis* sp. nov. The two species *T. acuta* Lom, 1961 and *Tripartiella macrosoma* Basson & Van As, 1987 are recorded for the first time in China. *Ctenopharyngodon idellus* and *Hypophthalmichthys molitrix* are new hosts for *Tripartiella macrosoma*. *Hypophthalmichthys molitrix* and *Aristichthys nobilis* are new hosts for *Trichodinella epizootica*, and *Aristichthys nobilis* is a new host for *T. acuta* and *T. nobilis*. These species are described below.

2 Materials and Methods

The host fishes, *Aristichthys nobilis*, *Hypophthalmichthys molitrix* and *Ctenopharyngodon idellus* were obtained from the study area during the months February to September 2005, and then transported back to the laboratory for parasitological examination. Gill smears were made from freshly cultured fish. Smears with trichodinids were air-dried and impregnated with silver nitrate in order to reveal details of the adhesive disc. The nuclear apparatus was revealed using methyl green pyronin stain (Foissner, 1991).

Examinations of prepared slides were made with a NIKON-E 600 phase contrast microscope and all photomicrographs and drawings were made with the help of a camera lucida (NIKON-DXM1200) at $\times 1250$ magnification and computer software CorelDRAW 11.0. All measurements are in micrometers (μm) and follow the uniform specific characteristic system proposed by Lom (1958). In each case minimum and maximum values are given, followed in parentheses by the arithmetic mean and standard deviation. In the case of the denticles and radial pins, the mode is provided instead of the arithmetic mean. Body diameter is measured as the adhesive disc plus the border membrane. The description of the denticle follows the format

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recommended by Van As & Basson (1989). All measures are given in microns below.

3 Results and Comparisons

Trichodina obtusiformis sp. nov. (Figs. 1-2, 7-8; Table 1)

Host and location. Gills of *Aristichthys nobilis*.

Type locality. Chongqing ($29^{\circ} 5' N$, $106^{\circ} 5' E$), China.

Date of sampling. Apr. 2005.

Type specimens. Holotype (CQ 20020401-01) and paratype (CQ 20020401-02) are deposited in the Collection Center of the Key Laboratory of Animal Biology in Chongqing Normal University.

Etymology. The specific name comes from the shape of the denticle. It is a composite of the Latin prefix “*obtus*” (= blunt) and the Latin suffix “-*formis*” (= shape).

Morphological description. Large, freshwater trichodinid with disc shape and concave adhesive disc, surrounded by a finely striated border membrane.

Table 1. Morphometric comparison of *Trichodina obtusiformis* sp. nov. and *T. cooperi* Poynton & Lom, 1989. (Measured in μm)

Trichodinid species	<i>Trichodina obtusiformis</i> sp. nov.	<i>T. cooperi</i> Poynton & Lom, 1989
Host	<i>Aristichthys nobilis</i>	<i>Gadus morhua</i>
Locality	Chongqing	Nova Scotia
Location	Gills	Skin and fins
Body diameter	60.0-105.0 (79.3 ± 14.4)	95-122 (110)
Adhesive disc	52.0-94.0 (69.3 ± 13.7)	82-107 (95)
The denticulated ring	35.0-63.0 (47.2 ± 8.7)	49-67 (59)
Border membrane	4.0-5.0 (4.6 ± 0.5)	6.4-8.9 (7.4)
Denticle number	26-29	24-29 (27)
Radial pins per	1-12	7-9
Denticle span	18.0-30.0 (22.6 ± 4.1)	23.6-32.5 (28.5)
Denticle length	7.5-13.5 (10 ± 1.9)	20.4-24.5 (21.5)
Blade length	5.0-8.0 (6.8 ± 1.1)	7.5-10 (8.6)
Central part width	5.5-10.0 (6.5 ± 1.5)	3.2-6.3 (4.8)
Ray length	8.0-12.0 (9.4 ± 1.6)	10.2-19.1 (15.4)
Adoral ciliary spiral	390°-410°	370°-380°
Number of specimens measured	12	—

Statistical mode, Min-Max (Mean \pm SD).

have been described from freshwater fish: *Aristichthys nobilis* (Richardson, 1845), *Trichodina lieni* Chen, 1956, *T. nigra* Lom, 1961, *T. nobilis* Chen, 1963, *T. domerguei* Wallengren, 1897, *T. rectanguli* Chen et Hsieh, 1964, *T. pediculus* (Mueller, 1786) and *Tripartiella bulbosa* (Davis, 1947). They all differ from our species in diameters of the body, adhesive disc and the shape of the denticle.

If the shape of the denticle is considered, only one poorly known species *Trichodina cooperi* Poynton &

Central zone of adhesive disc without granules in most specimens but in a minority of specimens with some granules (ratio about 3/1). Blade broad and robust, filling most of space between Y axes and with sharp tangent point. The anterior margin extending past Y+1 axis. The posterior surface forming a small semi-lunar arch with the Y axis, deepest point of indentation on the same level as apex of anterior margin. Distal surface of blade smooth. The section connecting the blade very thick, indistinguishable from the central part, which is strongly developed, fitting tightly into the preceding denticle with a blunt rounded point, extending halfway to Y-1 axis. Shapes of the central part above and below the X axis nearly similar. Posterior projection visible. Ray connection stumpy, inconspicuous and barely distinguishable from ray. Ray straight, tapering sharply towards rounded point, parallel to Y axis. Apophysis of ray absent. Macronucleus G shaped, micronucleus not observed. Measurement in Table 1.

Remarks. Up to date 7 species of trichodinids

Lom, 1989 is found to be closely related to our species. However, the new species differs in the following characters 1) *T. obtusiformis* has a smaller body diameter (60.0-105.0 in our species vs. 95.0-122.0 in *T. cooperi*); 2) length of blade and thorn is shorter than that of *T. cooperi* respectively (5.0-8.0 vs. 7.5-10.0), (8.0-12.0 vs. 10.2-19.1); 3) the section connecting to the blade of our species is much stronger and more stumpy than that of *T. cooperi*; 4) the central part in the new species is wider than that in *T. cooperi* (5.5

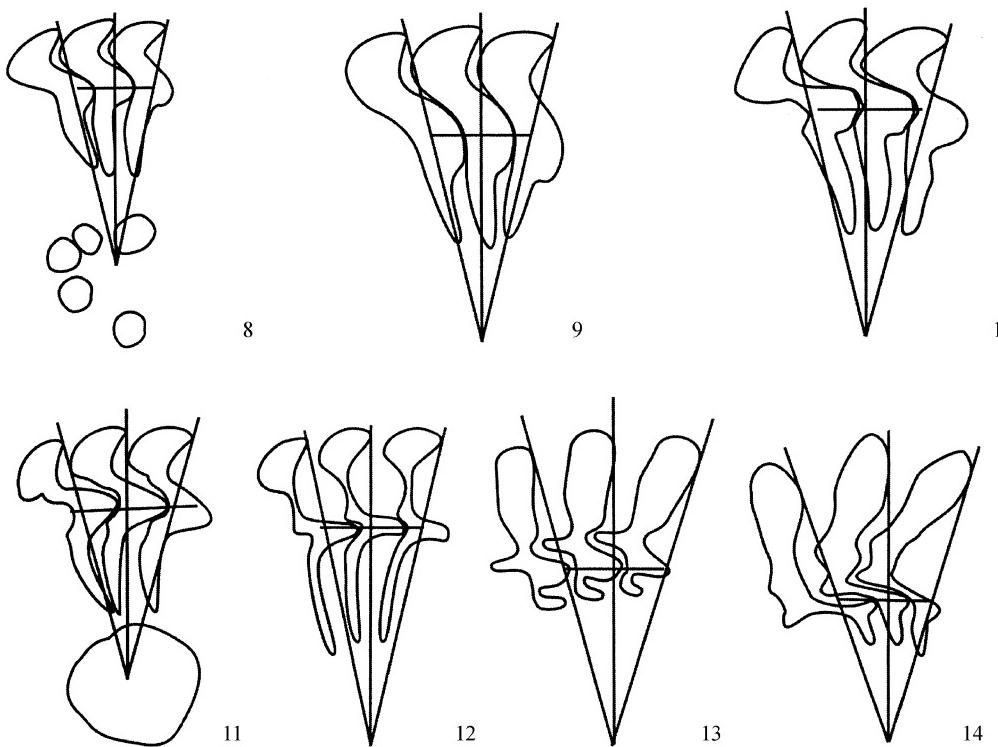


Figs 1-7. Photomicrographs of silver-impregnated specimens of trichodinid species. 1, 3. *Trichodina obtusiformis* sp. nov. 1. Impregnated adhesive disc of *T. obtusiformis* without granules. 2. Impregnated adhesive disc of *T. obtusiformis* with some granules. 3. A doral ciliary spiral of *T. obtusiformis*. 4. *T. acuta* Lom, 1961. 5. *T. nobilis* Chen, 1963. 6. *Tripartiella macrosoama* Basson & Van As, 1987. 7. *Trichodinella phizotica* (Rabbe, 1950) Sramek Husek, 1953. Scale bars= 20 μ m.

10.0 vs. 3. 2-6. 3); 5) the number of radial pins per denticle is 11 to 12 versus 7 to 9 in *T. cooperi*.

Other differences are: 1) *T. cooperi* was taken from *Gadus morhua* (a marine fish), while *T.*

obtusiformis was obtained from the freshwater fish, *Aristichthys nobilis*; 2) *T. obtusiformis* is also different from *T. cooperi* in the adoral ciliary spiral (390° - 410° vs. 370° - 380°); 3) there are some granules



Figs. 8-14. Diagrammatic drawings of the denticles of trichodinids. 8-9. *Trichodina obtusiformis* sp. nov. 10. *T. cooperi* (Poynton & Lom, 1989) from *Gadus morhua*. 11. *T. acuta* Lom, 1961. 12. *T. nobilis* Chen, 1963. 13. *Trichodinella epizootica* (Rabbe, 1950) Sramek Husék, 1953. 14. *Tripariella macrosoma* Basson & Van As, 1987.

in some specimens of our species, whereas no granules in *T. cooperi*.

It is interesting that there are some granules in the central zone of some specimens in the new species. Maybe these animals are immature and the granules haven't developed yet. This problem needs further study.

In view of the blunt blade, stumpy section connecting the blade, and some granules in some specimens in our species, we consider the erection of the new species justified.

Trichodina acuta Lom, 1961 (Figs. 3, 10)

Host, location, locality and date of sampling. Gills of *Aristichthys nobilis* from Chongqing, China in February 2005.

Redescription. Large, freshwater species with disc shaped body; 64.1 ± 2.9 (60.0-70.0) in diameter. Adhesive disc concave, 56.2 ± 3.2 (50.0-60.0) in diameter; surrounded by finely striated border membrane 4.4 ± 0.3 (4.0-5.0) wide. Diameter of denticle ring 33.2 ± 2.6 (28.0-37.0). Central disc clear with single granule, 12.0-13.0 in diameter. Number of denticles 21-25. Number of radial pins per denticle 9-10. Length of denticle 9.4 ± 0.4 (8.5-10.0). Span of denticle 16.4 ± 0.9 (15.0-

18.0). Length of blade 5.5 ± 0.4 (5.0-6.0). Blade broad, with sharp tangent point. Distal surface of blade smooth. Apophysis of blade present. Blade connection relatively thin. Posterior projection visible. Central part broad and conical, 3.5 ± 0.4 (3.0-4.0) in width. Tip of central part extending halfway past Y-1 axis. Section of central part above and below x axis similar in shape. Ray connecting very short. Ray apophysis present. Ray slightly bent with sharp point, length of ray 7.4 ± 0.6 (6.0-8.5). Adoral ciliary spiral more than 360° .

Remarks. This species was first described from Czechoslovakia by Lom (1961). Later it was found from other hosts of various regions, such as *Oncorhynchus mykiss* (Basson & Van As, 1993) from South Africa and *Tilapia zillii* (Duncan, 1977) from Philippine. The species was the first record in China.

Trichodina nobilis Chen, 1963 (Figs. 4, 11)

Host, location, locality and date of sampling: gills of *Aristichthys nobilis*, *Hypophthalmichthys molitrix* and *Ctenopharyngodon idellus* from Chongqing, China in February and June 2005.

Redescription. Large sized trichodinid with the disc shape; 83.4 ± 3.8 (80.0-92.0) in diameter. Disc concave, 72.8 ± 4.2 (69.0-81.0) in diameter;

surrounded by a finely striated border membrane of 5.2 ± 1.0 (3.0-6.0) wide. Diameter of denticle ring 50.3 ± 4.1 (45.0-58.0). Number of denticles 26-28 and 11-12 radial pins per denticle. Length of denticle 9.8 ± 1.2 (9.0-13.0). Span of denticle 24.2 ± 1.8 (21.0-28.0). Length of ray 11.7 ± 1.1 (10.0-13.5). Blade fans with sharp tangent point, length of blade 8.6 ± 1.1 (7.0-10.0). Apophysis of blade present. Distal surface of blade smooth. Central part well developed, 3.2 ± 0.4 (3.0-4.0) in width. Central part fitting tightly into blade apophysis of preceding denticle. Ray extremely slender and straight with blunt point, length 11.7 ± 1.1 (10.0-13.5), parallel to Y axis. Ray apophysis absent. Adoral ciliary spiral turns about 390° - 400° .

Remarks. The morphometric data of our population fit into the range of *T. nobilis* described originally from the gills and skin of *Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Ctenopharyngodon idellus* and tadpoles in China by Chen (1963), as well as from other freshwater fishes (Lom, 1970 & Kashkovsky, 1974). *T. nobilis* was firstly found from the host *Aristichthys nobilis*.

Trichodinella epizootica (Rabbe, 1950) Sramek Husek, 1953 (Figs. 6, 12)

Host, location, locality and date of sampling. Gills of *Aristichthys nobilis* and *Hypophthalmichthys molitrix* from Chongqing, China in February and April 2005.

Redescription. Small, freshwater *Trichodinella* with disc-shaped; 24.1 ± 2.5 (20.0-28.5) in diameter. Adhesive disc concave, 20.2 ± 2.6 (16.0-24.5) in diameter; surrounded by finely striated border membrane 2.0 ± 0.1 (1.5-2.0) wide. Diameter of denticle ring 11 ± 2 (8.5-16.0). Number of denticles 21-25. Length of denticle 2.4 ± 0.2 (2.0-3.0). Span of denticle 5.3 ± 0.7 (4.0-6.5). Length of blade 3.8 ± 0.5 (3.0-4.5). Number of radial pins per denticle 5. Blade broad. Distal blade surface smooth; anterior margin not far touching the Y+1 axis; tangent point blunt, lower than distal blade surface. Central part relatively developed, 0.7 ± 0.2 (0.5-1.0) in width. Length of curved hook hook-shaped ray 0.5 ± 0.1 (0.5-1.0). Point of ray blunt and rounded. Adoral ciliary spiral turns about 180° .

Remarks. The morphometric data and denticle shape of our population are consistent with the description of *Trichodinella epizootica* Lom (1961), which is one of the most widely distributed trichodinid

species occurring on the gills of freshwater fishes. It is the first time that *Trichodinella epizootica* has been found on gills of *Hypophthalmichthys molitrix* and *Aristichthys nobilis*.

Tripartiella macrosoma Basson & Van As, 1987 (Figs. 5, 13)

Host, location, locality and date of sampling. Gills of *Hypophthalmichthys molitrix* and *Ctenopharyngodon idellus* from Chongqing, China in June and September 2005.

Redescription. Small-sized, freshwater *Tripartiella* with pot-shaped body; 23.1 ± 1.6 (20.0-26.0) in diameter. Adhesive disc 18.9 ± 1.3 (16.5-20.0); border membrane 2.1 ± 0.2 (2.0-2.5) in width. Diameter of denticle ring 8.3 ± 0.4 (8.0-9.0). Number of denticles 24-27. Number of radial pins per denticle 4-5. Length of denticle 2.3 ± 0.2 (2.0-2.5). Span of denticle 6.2 ± 0.3 (6.0-6.5). Length of blade 3.8 ± 0.3 (4.0-5.0). Blade broad with rounded bulbous distal parts. Distal surface of blade rounded. Tangent point blunt. Anterior blade margin sloping downwards, extending past Y+1 axis. Blade apophysis distinct, extending tightly into indentation of the next denticle. Second blade apophysis pronounced, corresponding to indentation in anterior margin of next blade. Posterior blade margin extending from Y axis sloping downwards to Y+1 axis. Section connecting blade short. Central part very small with 0.7 ± 0.2 (0.5-1.0) in width. Ray straight and short, extending directly from central part, length of ray 0.5 ± 0.1 (0.5-1.0). Angle of posterior blade margin to blade connection almost 90° . Adoral ciliary spiral turns about 280° - 300° .

Remarks. *Tripartiella macrosoma* was originally described from *Barbus eutaenia* by Basson & Van As (1987). Our specimens are slightly larger than those of the original description and the adoral ciliary spiral is also different (280° - 300° in our population vs. 170° - 230° in the original population). It is the first report for *T. macrosoma* in China.

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寄生于重庆地区鲢、鳙及草鱼五种外寄生车轮虫的描述

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摘要 对采自重庆地区寄生于鲢、鳙及草鱼鳃上的5种外寄生车轮虫进行了形态学及分类学研究, 其分别隶属于: 车轮虫属、小车轮虫属及三分虫属, 其中包含1新种和中国2新纪录。即钝圆车轮虫 *Trichodina obtusiformis* sp. nov., 急尖车轮虫 *T. acuta* Lom, 1961, 显著车轮虫 *T. nobilis* Chen,

关键词 纤毛门, 缘毛目, 车轮虫科, 新种, 淡水鱼。

中图分类号 Q959.117.6

1963, 周丛小车轮虫 *Trichodindla epizootica* (Rabbe, 1950) Sramek Husek, 1953 和大型三分虫 *Tripartidla macrosoma* Basson & Van As, 1987。文中对新种进行了详细的描述并提供了新种及已知种的附着盘银染标本之显微照片及齿体线条图。